Democratic Republic of the Congo



Demographic and Health Survey (DRC-DHS II)

2013-2014

Supplemental Malaria Report

DEMOCRATIC REPUBLIC OF THE CONGO

DEMOGRAPHIC AND HEALTH SURVEY (DRC-DHS II 2013-2014)

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April 2015

The second Demographic and Health Survey in the Democratic Republic of Congo (DRC-DHS II 2013-2014) was conducted by the Ministry of Monitoring, Planning and Implementation of the Modern Revolution [Ministère du Plan et Suivi de la Mise en Oeuvre de la Révolution de la Modernité], in collaboration with the Ministry of Public Health [Ministère de la Santé Publique]. The DRC-DHS II was financed by the government of the Democratic Republic of Congo (DRC), the US government through the United States Agency for International Development (USAID), the President's Emergency Plan for AIDS Relief (PEPFAR), the Department for International Development (DFID), the World Bank through the Health Sector Rehabilitation Support Project [Projet d'Appui à la Réhabilitation du Secteur de la Santé (PARSS)], the Global Fund through the ASBL Primary Health Care in Rural Areas [Soins de Santé Primaire en Milieu Rural] (SANRU), the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), and the Bill & Melinda Gates Foundation through the University of California, Los Angeles (UCLA). Other institutions also provided assistance for the survey, notably the National AIDS and STI Control Program's Reference Laboratory [Laboratoire National de Référence (LNR) du Programme National de Lutte contre le VIH/Sida et les Infections Sexuellement Transmissibles (PNLS)], The National Institute for Biomedical Research [Institut National de Recherche Biomédicale (INRB)], Family Health International (FHI 360), and the Centers for Disease Control and Prevention (CDC). ICF International provided technical assistance to the entire project via the MEASURE DHS project, financed by USAID, which provides support and technical assistance for population and health surveys in countries worldwide. The Kinshasa WHO office also provided logistical support, notably in clearing medical supplies through customs.

Additional information about the DRC-DHS II 2013-2014 may be obtained from the Ministère du Plan et SMRM, 4155, Rue des Coteaux, Quartier Petit Pont, Kinshasa/Gombe, BP 9378 Kin 1, Kinshasa; E-mail: miniplan@gmail.com.

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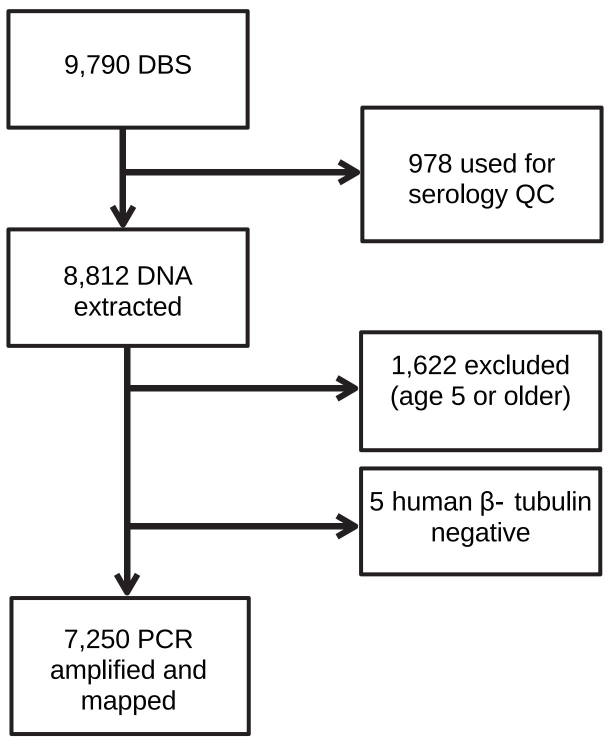
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The second Demographic and Health Survey in the Democratic Republic of Congo (DRC–DHS II) is designed to provide data for monitoring the population and its health in the Democratic Republic of Congo (DRC). The DRC-DHS II provides reliable data on fertility and fertility preferences, sexual activity, knowledge and use of family planning, breastfeeding, the nutritional status of women and children under age 5, childhood mortality, adult mortality (including maternal mortality), maternal and child health, HIV/AIDS and STI knowledge, and the use of mosquito nets to prevent malaria. Additionally, the survey included testing for HIV, anemia, and malaria.

Fieldwork for the DRC-DHS II took place from November 2013 to February 2014. During the survey, 18,827 women age 15-49 in all selected households and 8,656 men age 15-59 in half of the selected households were successfully interviewed.

The DRC has one of the highest burdens of malaria in the world. In areas of high malaria endemicity, most infections are asymptomatic. Furthermore, many or most individuals with asymptomatic infections have parasitemias that are not detectable by microscopy or rapid diagnostic tests (RDTs); they are only detectable by polymerase chain reaction (PCR) (Lin et al. 2014). We used PCR, therefore, to ascertain malaria in children age 6 to 59 months, in order to find infections that otherwise would have been missed.

We obtained dried blood spots (DBS) from 9,790 children enrolled in the DRC-DHS II. The DBS were processed according to the following flow chart:



DNA was extracted from the DBS using Chelex (Okell et al. 2009) and PCR-amplified for *Plasmodium falciparum* lactate dehydrogenase (DNA) as previously described (Singh et al. 1999) using human β-tubulin as a DNA control (Beshir et al. 2010). Weighting for populations, 34.1 percent of children were PCR-positive for *P. falciparum* malaria. In contrast, 22.7 percent and 30.9 percent were positive by microscopy and RDT, respectively (Table 1). The map shows weighted prevalence in the 26 *Divisions Provinciales de la Santé* (DPS).

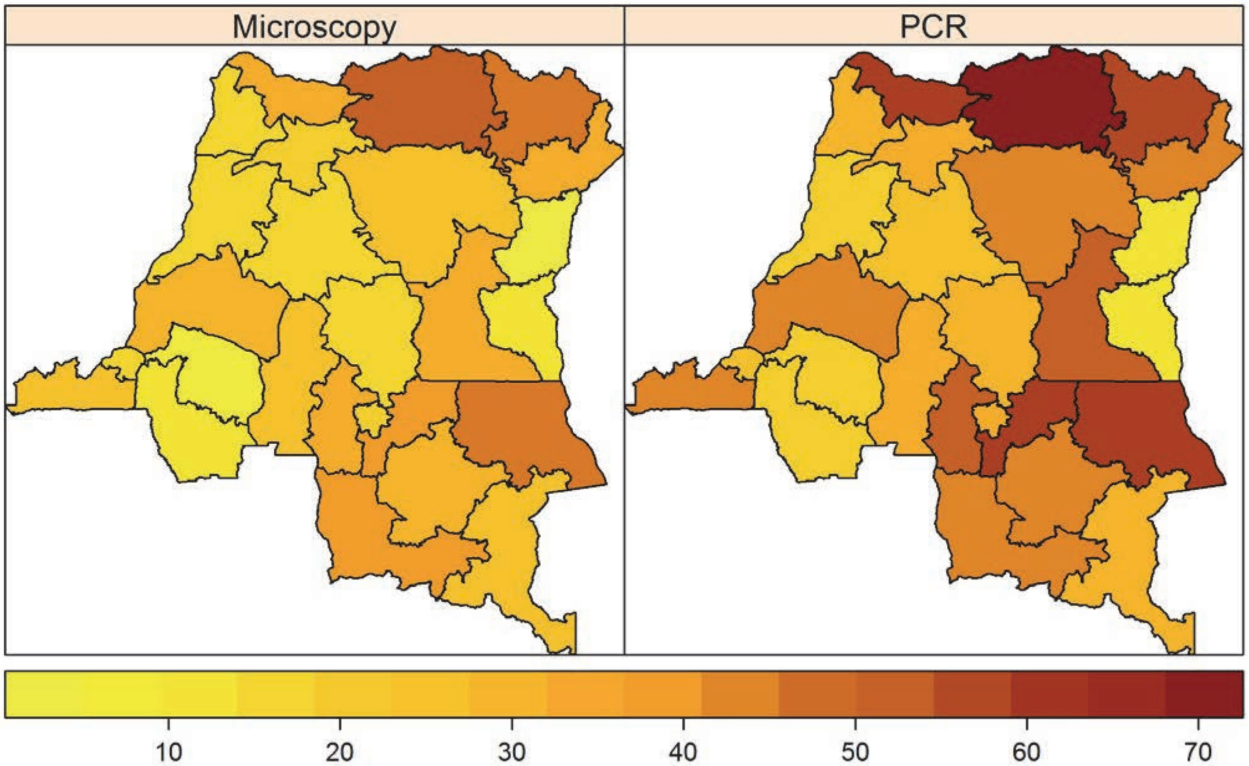
PCR prevalence, like microscopy, increased with age and was higher among those living in rural areas than in urban areas. PCR prevalence ranged from 10 to 68 percent (Table 1, Figure 1).

Table 1 Prevalence of malaria in children age 6-59 months, DRC-DHS II 2013-14

Demographic characteristics	Microscopy (n=8050)	RDT (n=8077)	PCR (n=7250)
Age group (months)			
6-8	12.7	15.4	26.0
9-11	12.7	20.9	24.0
12-17	15.0	23.5	28.3
18-23	19.9	25.1	28.2
24-35	23.8	29.9	34.8
36-47	28.0	38.3	39.0
48-59	28.3	37.3	38.8
Sex			
Male	23.3	30.7	34.3
Female	22.1	31.1	33.9
Residence			
Urban	19.5	25.0	29.8
Rural	24.1	33.4	35.9
Province			
Kinshasa	18.3	17.0	25.8
Bas-Congo	23.2	45.7	42.5
Bandundu	14.7	20.6	26.2
Equateur	19.1	27.4	32.2
Orientale	38.2	49.5	51.5
Nord-Kivu	4.9	2.8	12.2
Sud-Kivu	9.6	11.3	10.4
Maniema	34.3	43.9	50.3
Katanga	31.8	39.5	41.8
Kasai Oriental	28.8	49.1	47.8
Kasai Occidental	32.2	44.6	43.7
DPS			
Bas-Uele	53.3	73.2	68.2
Equateur	14.6	26.4	22.5
Haut-Katanga	24.9	26.3	31.7
Haut-Lomami	27.7	42.2	43.0
Haut-Uele	47.8	67.6	57.5
Ituri	34.7	43.9	44.0
Kasai	26.7	40.9	34.1
Kasai-Central	36.4	47.4	51.0
Kasai-Oriental	22.4	36.4	36.4
Kinshasa	18.3	17.0	25.9
Kongo Central	23.2	45.7	42.5
Kwango	10.9	20.9	19.7
Kwilu	7.8	13.9	18.9
Lomami	37.6	65.8	63.6
Lualaba	38.0	42.4	44.8
Mai-Ndombe	29.7	30.8	45.1
Maniema	34.3	43.9	50.3
Mongala	20.7	25.4	36.5
Nord-Kivu	4.9	2.8	12.2
Nord-Ubangi	33.0	47.0	61.5
Sankuru	17.9	31.1	27.8
Sud-Kivu	9.6	11.4	10.4
Sud-Ubangi	17.2	24.0	29.4
Tangankya	48.6	66.0	61.6
Tshopo	24.7	26.3	45.0
Tshuapa	18.0	26.1	26.2
Total	22.7	30.9	34.1

Note: Results are nearly identical when restricted to 7,185 subjects with all three tests.

***Figure 1* Prevalence of malaria in children age 6-59 months by *Division Provinciale de la Santé*, DRC-DHS II 2013-14**



Percentage of children with malaria as diagnosed by microscopy or PCR

COMPARISONS OF MALARIA MEASURES

Microscopy vs. PCR: Malaria prevalence was 50 percent higher by PCR than by microscopy (34.1 percent vs. 22.7 percent). This is consistent with previous studies; PCR detects lower levels of parasitemias than microscopy (Okell et al. 2009).

The DHS microscopists were not asked to speciate malaria parasites. There were 219 microscopy-positive, PCR-negative subjects. Since our PCR protocol was specific for *P. falciparum*, we suspected that many of these discordant cases represented infections with non-*falciparum* malaria parasites. We ran additional PCR reactions on these samples to amplify a region of the 18S rRNA gene shared by all human *Plasmodium* parasites (Taylor et al. 2010), followed by sequencing to assign species (Singh et al. 2009). Most of the sequences were either *P. falciparum* or indeterminate; only 26 and 20 sequences homologous to *P. malariae* and *P. ovale*, respectively, were found. Thus, accounting for uncertainty due to indeterminate PCRs, the prevalence of microscopically patent infections with *P. malaria* or *P. ovale* without *P. falciparum* co-infection was between 0.6 percent and 1.7 percent.

RDT vs PCR and microscopy: The prevalence determined by rapid diagnostic tests (RDTs) (30.9 percent) was similar to that determined by PCR (34.1 percent). However, 517 (18 percent) of the RDT positives were both PCR-negative and microscopy-negative. Most likely, these RDT false-positives were due to persistence of HRP-2 in the circulation after parasite clearance. The RDT diagnostic specificity in this survey was ~90 percent, which is similar to the RDT specificity reported in East Africa (Abeku et al. 2008).

SUMMARY

The results of this study show that PCR is a more sensitive surveillance tool than microscopy; the PCR malaria infection prevalence in children age 6-59 months was 34.1 percent, similar to that found by PCR analyses (33.5 percent) of adult samples from the 2007 DRC-DHS (Taylor et al. 2011). In addition, comparisons among PCR, microscopy, and RDT suggest that RDTs (but not microscopy) generate frequent false-positive results. As indicated, however, the RDT false positives were likely due to the persistence of HRP-2 in the circulation after parasites had been cleared. Finally, molecular analyses suggest that the frequency of mono-infections with *P. ovale* or *P. malariae* is low.

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